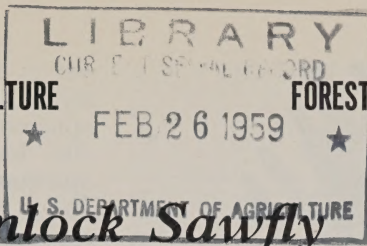


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Hemlock Sawfly

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The hemlock sawfly (*Neodiprion tsugae* Midd.) is an important defoliator of western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) in the coastal forests of Oregon, Washington, British Columbia, and Alaska (fig. 1). It occasionally becomes evident in interior British Columbia and portions of Idaho and Montana.

Middleton first described this insect in 1933, but outbreaks were known before then. Epidemics may persist several years, but usually are severe for only a year or two. Heavy

defoliation may result in the death of trees, although some epidemics subside with little immediate tree mortality. Heavy defoliation also results in lowered tree vigor that may allow diseases and other insects to exact additional tree losses.

The hemlock sawfly is often found working in association with, or immediately following, epidemics of other defoliating insects. Losses to hemlock have been particularly heavy where this pest has worked in association with the black-headed budworm (*Acleris variana* (Fern.)). Inasmuch as the sawfly prefers old foliage and the budworm prefers new, a combination of the two insects may result in complete defoliation.

Host Trees

Western hemlock is the primary host of this sawfly. Mountain hemlock (*Tsuga mertensiana* (Bong.) Carr.) and, occasionally, Pacific silver fir (*Abies amabilis* (Dougl.) Forbes.) are also defoliated, particularly where they occur in close association with western hemlock.

Evidence of Infestation

Developing larvae feed gregariously on the needles. Several young larvae usually are found on each needle, and each larva is aligned along the needle with its head toward the tip end. Feeding progresses from the tip back toward the base and is confined to older foliage, except that maturing larvae may feed on new foliage (fig. 2). Young larvae always feed in groups or large clusters, but older larvae

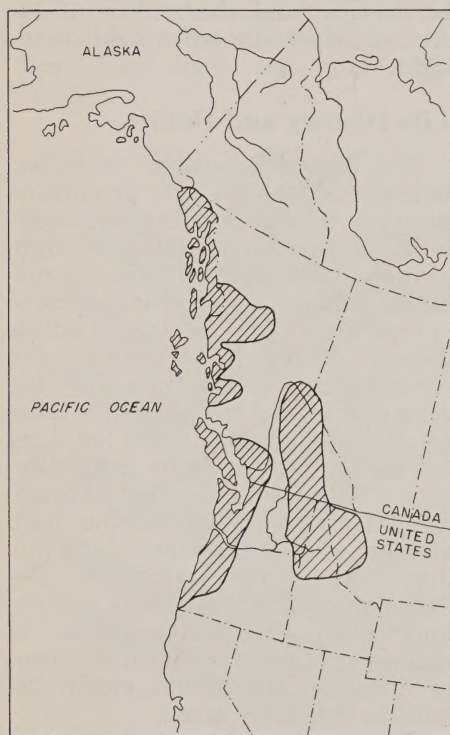


Figure 1.—Distribution of the hemlock sawfly in western North America.

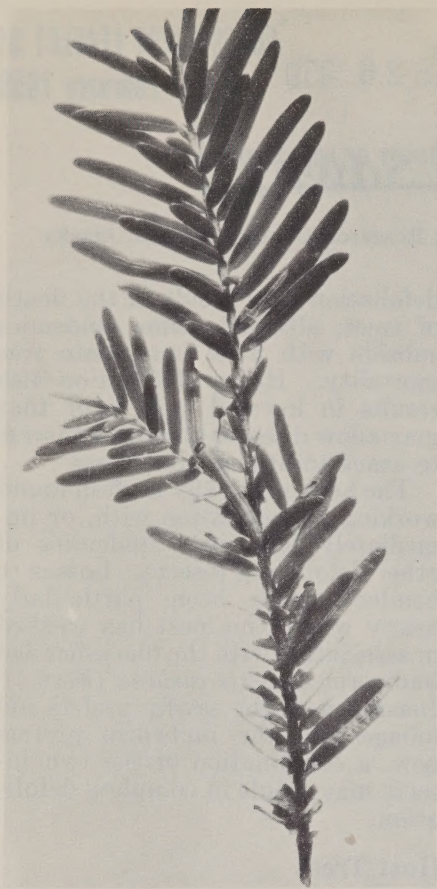


Figure 2.—Larvae and characteristic feeding damage to western hemlock.

are less gregarious and tend to feed singly. Heavy defoliation causes trees to appear gray or grayish-brown and tree crowns to appear thin. Green or partially eaten needles may be observed beneath infested trees. When defoliation has been in progress one season or more, pupal cases are evident on twigs, needles, tree trunks, and just beneath the surface of the duff.

Description

Adults.—Adults of the hemlock sawfly are yellow brown to dark brown in color with dark brown or black antennae, possess two pairs of

wings, and are about one-quarter of an inch long. The males have conspicuous feathery antennae, whereas the female antennae are inconspicuous and threadlike (fig. 3).

Eggs.—The eggs are small, flattened, oval, yellowish white, and somewhat transparent (fig. 4).

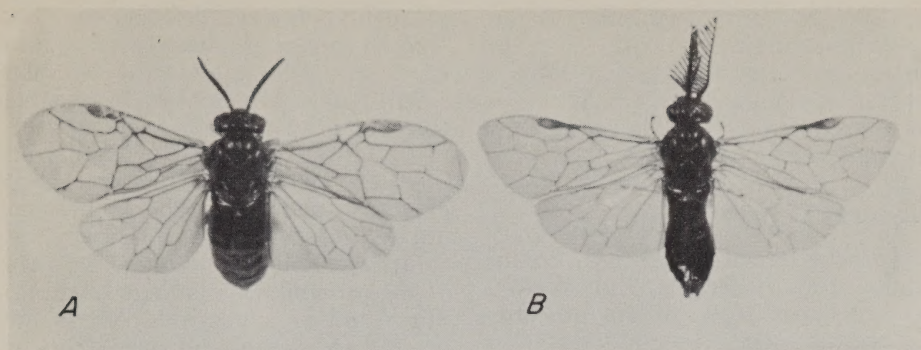
Larvae.—Young larvae are nearly black with a greasy appearance. Later they develop a greenish cast and acquire longitudinal stripes when about half grown (fig. 5, *B*). Full-grown larvae vary in color from yellow green to gray. The heads are black throughout development. The larvae usually pass through five stages and when fully grown are slightly less than 1 inch long.

Cocoons.—The cocoons are silvery brown, have a papery texture, and are a little over a quarter of an inch long. They resemble a very small cylinder, rounded on each end (fig. 5, *A*). A dark band can sometimes be seen around the middle of the cocoon, especially when held to the light.

Life History and Habits

The hemlock sawfly characteristically completes one generation per year throughout its range; however, a variable number of individuals hold over in the cocoon stage, taking two or more years to complete a life cycle. Adults appear during late summer and early fall, at which time they lay eggs and die. Overwintering takes place in the egg stage, and hatching occurs by late spring or early summer. The larvae develop through five successive stages during mid-summer and form cocoons from late July to about mid-September. Because of seasonal variations and the long north-south distribution of this insect, there are wide differences in the dates the insects attain the various stages by areas.

The eggs are deposited in small slits cut by the female along the under side of the edge of the tip



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Figure 3.—Hemlock sawfly adults ($\times 4\frac{1}{2}$): *A*, Female; and *B*, male.

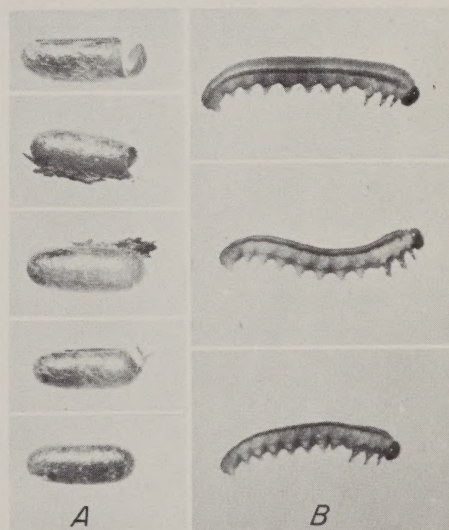
half of the needle. They are laid only in hemlock needles of the current year's growth, usually one per needle, occasionally two but rarely more. Small dark spots appear in the eggs just prior to hatching. The young larvae are gregarious and always feed in groups or large clusters. When disturbed they hold on to the needles with their hind legs and move the forepart of their body back and forth. The

older larvae tend to feed individually and in the last feeding stage are restless and move frequently, feeding sporadically. Just prior to forming cocoons the larvae enter a nonfeeding stage. These nonfeeding larvae are foreshortened, possess no stripes, and are entirely light green in color. Cocoons may be formed on twigs, needles, or other parts of the tree, but most are formed just beneath the surface of the duff immediately beneath the defoliated tree. They are not nor-



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Figure 4.—Eggs near tips of hemlock needles ($\times 1\frac{1}{2}$).



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Figure 5.—Hemlock sawfly: *A*, Cocoons ($\times 1\frac{1}{2}$); *B*, larvae ($\times 2$).

mally found in mineral soil. A few individuals do not overwinter in the usual egg stage, but instead remain as pupae within cocoons. After one or more winters in this stage they emerge as adults.

Natural Control

Insect parasites, disease, mammals, and other natural factors usually provide a control on sawfly populations. Several hymenopterous parasites are important, especially during epidemics. Two of the more important of these parasites are *Delomerista diprionis* Cush. and *Itopectis montana* Cush. Cocoons deposited in the duff fall easy prey to mammals. Over 50 percent of these cocoons have been destroyed in one season.

Applied Control

No control programs have been carried on against this insect. Normally, outbreaks subside from natural causes before direct control measures become necessary.

DDT and some of the other chlorinated hydrocarbon insecticides have been used successfully in controlling outbreaks of other related sawflies, as well as a variety

of other forest defoliators. Although none of these insecticides have been tried against the hemlock sawfly, it is reasonable to assume that an aerial application of 1 pound of DDT per gallon of light fuel oil per acre would be effective. For ground spraying, where heavier applications would be necessary, oil solutions should be avoided because of the possibility of foliage burning. Suggested as a possible control for ground application on small trees or ornamentals is a solution of 1 quart of 25 percent DDT emulsion concentrate in 3 quarts of water.

Caution: DDT is poisonous and should be used with adequate precaution. Store in a safe place, away from food and correctly labeled. Use care in applying DDT, and avoid excessive amounts, especially in aerial spraying where lakes and streams may occur.

References

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